

# Japan's industrial development policy and the construction of the nobiru port : the case study of a failure

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**JAPAN'S INDUSTRIAL DEVELOPMENT POLICY  
AND THE CONSTRUCTION OF THE NOBIRU  
PORT: THE CASE STUDY OF A FAILURE**

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This paper is being circulated in a pre-publication form to elicit comments from readers and generate dialogue on the subject at this stage of the research.

## INTRODUCTION

**W**ITHIN a very short time following the Meiji Restoration of 1868, the new Japanese government devised and implemented a special policy for the promotion of industry and commerce. The aim of this policy was to free Japan from the pressures then being brought to bear on it by foreign capital which was making inroads into the country and to establish industrial capitalism firmly and quickly in order to permit the growth of an independent economy. The government's first step in this direction was to place all railroads, mines, and factories under the authority of the Ministry of Industry, created in 1870. With the establishment of the Ministry of Interior in 1873 presided over by Toshimichi Ōkubo, this policy assumed a much greater importance. After 1878 and the defeat of Saigō's forces in the Seinan civil war fought in Kagoshima (Satsuma), attention came to be focused on the development of traditional, endogenous industries. To stimulate the growth of these activities, a comprehensive public works program was drafted. Its objective was to protect and encourage the growth of special local products and to develop a modern transportation system consistent with the needs of industry in general. The capital to finance these projects was raised from the private sector by floating a public bond issue, i.e., through the sale of industrial promotion bonds, and came to be known as the industrial promotion fund.

Among the various development projects funded with this money was the construction of port facilities at Nobiru in Sendai Bay, Miyagi Prefecture, the subject of this essay. Conceived as a public works project, the Nobiru port plan was carried out under the direct jurisdiction of the Ministry of Interior. The construction of Nobiru port raises a number of seminal questions about early industrial development in Japan. Specifically, I hope to clarify the following points:

(1) The first point concerns the background against which planning for the project was carried out and Nobiru's place in the state's industrial development

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program. I shall look specifically at the measures taken to aid and appease nobles and former samurai in the wake of the Satsuma rebellion, the development policy devised for the Tōhoku region, which had been devastated by the internal disorders that attended the Restoration, and certain problems of domestic policy—and their countermeasures—such as the regulation of the price of rice following the reform of the land-tax system after 1873.

(2) Next, I shall take up the repair of the Ishinomaki port, the survey conducted for this purpose in 1876–77, and the first plans for the construction of a port at Nobiru which evolved out of it. Particular attention will be paid to the preliminary survey reports submitted by the Dutch engineer Van Doorn and to the first and second phases of the Nobiru project.

(3) A third point of focus will be the progress of work on the port and related construction projects that took place from 1878 to 1884. These latter include the excavation of drainage ditches and the Tōna canal and the development of the site for Nobiru city.

(4) I shall also consider the special importance of the secondary development projects that grew out of the Nobiru plan, such as the construction of the Sakunami-Sekiyama and the Yokote-Kurosawajiri overland routes (1880–82). An 1881 report suggesting the raising of a bond issue to finance development programs will receive special mention.

(5) A fifth and final point is the outcome of the Nobiru project and its general assessment. Specifically, I shall be concerned with the plan to transfer port facilities from Nobiru to Onagawa (1884–86), the ultimate failure of the Nobiru plan (1887) and its causes, and the relationship between the foreign technical experts who drafted the original port plan and the officials of the Ministry of Interior who put it into operation.

Through these diverse considerations, I hope to arrive at an overall evaluation of the Nobiru port plan and its associated projects. Finally, I shall inquire into the nature of the motivating force behind this ambitious project, paying special attention to the role played by Interior and its dynamic young bureaucrats in implementing it. The construction of Nobiru port was planned as part of the government's industrial promotion policy, designed to hasten the modernization of Japan at a critical turning point in its history. The entire process of introducing foreign technology was essentially one of trial and error. The Nobiru project was one of the failures on the road to modernization. On this and other points, the Nobiru case holds much of interest for students of the contemporary problems of national development.

## I. THE CREATION OF THE INDUSTRIAL DEVELOPMENT FUND

The period during which the able Meiji bureaucrat-statesman Toshimichi Ōkubo finally succeeded in consolidating his autocratic hold over the new government is thought to coincide with the establishment of the Ministry of Interior, which Ōkubo was to head, between November 1873 and January 1874. This feat was accomplished amid factional disputes which erupted time and again after the

beginning of the Meiji period in the leading circles of government and the inside political fighting over the placement of government personnel that ensued. The so-called Ōkubo regime, built around Ōkubo and established through the centralization and close coordination of three government ministries, Interior, Industry, and Finance, quickly put the political influence of the newly consolidated administrative apparatus to work creating the structures necessary to support rapid industrialization.<sup>1</sup> This initiative gave substance to two national policy objectives actively pursued by the new state: the creation of "a rich nation, a strong army" and the drive to "foster production, promote industry" [5].

However, due to internal political divisions, the most prominent of which were evidenced in the samurai uprisings of early Meiji and the first phase of the movement for democratic rights, and to the influx of foreign capital in search of trade concessions, the task of translating these policy themes into specific projects did not proceed smoothly. The crisis of public finances that attended the establishment of the new regime was made worse by the reckless issue of inconvertible paper currency as the state attempted to offset the heavy military expenses it had incurred during the Seinan civil war of 1877. This blocked for the time being the implementation of government policy.

In the midst of these difficulties, two events occurred which immediately furthered the realization of state goals. The first was a letter of inquiry submitted by Ōkubo to Prime Minister Sanetomi Sanjō on March 6, 1878 entitled "Inquiry Concerning the General Development of Industry and the Creation of Employment for the Nobility and Ex-Warrior Class" [3]. The second event was the presentation of Minister of Finance Shigenobu Ōkuma's report to the prime minister seeking permission to raise public funds to finance the various projects outlined in Ōkubo's proposal. In his letter of inquiry to the government, Ōkubo explained the report's purpose as follows: "Among the myriad tasks before us, the most urgent at this time is to foster the national spirit by improving those special crafts and products native to the homeland and by assuring the security of the citizenry through the creation of lasting employment" [3].

However, Ōkubo noted, since the commutation of feudal stipends,<sup>2</sup> the mainstay of the old ruling class, nobles and former samurai had lost their fixed livelihoods. There was concern lest the daily dissatisfactions and frustrations of the idle, footloose existence into which they had fallen someday bring this class to act against the interests of the state. The Ministry of Interior had set up a vocational aid bureau in 1876 to deal with the problem, but it found its hands full meeting contingencies such as the revolt of Saigō in 1877. With the return of domestic peace, Ōkubo hoped to build a strong country by acting to insure the social stability of the ex-warrior class and by devising sound domestic

<sup>1</sup> It should be noted that from 1868 to 1885, the government was organized according to the Dajōkan system. (The First Imperial Diet did not convene until November 1890.) Ōkubo, a central figure among the ministers, took de facto control of the government which was nominally led by Sanjō. Ōkubo served as minister of interior three terms from November 1873 until May 1878 when he was assassinated by a dissatisfied ex-warrior.

<sup>2</sup> The government issued hereditary government bonds to former warriors in lieu of traditional revenues in 1875.



programs to occupy the people. To this end, he called for the creation of businesses by samurai and nobles as a means of creating employment. Expenditures for the program were to run to about 6 million yen, but it was estimated that approximately 90 per cent of this sum would be recovered. Ōkubo acknowledged that state spending was heavy but requested permission to implement his proposals.

While a formal report based on careful investigation was to be submitted once a project was authorized, Ōkubo advised, he nonetheless proceeded to outline budgets and methods for the major programs. Category I projects were designed to resettle 13,000 families of noble and samurai origin from all parts of the country on suitable land. This land was to be selected by local government officials, equipped with farm implements and dwellings by the central government and made available to the families on loan for development and cultivation. Included in this category was a project proposed in his "Letter of Inquiry Concerning the Reclamation of Wasteland" submitted the following day, March 7, 1878 [1]. The plan was proposed as a first step to send settlers to the Tōhoku region in order to "reclaim the Taimenbara plain and surrounding wasteland in Asaka County, Iwashiro District, Fukushima Prefecture." Category II projects aimed at loaning public wasteland situated about four kilometers from the place of residence of aristocrats and ex-warriors to those among them who wished to reclaim and farm it.

The category III initiatives, unlike the first two categories, were intended to develop production generally. For this purpose, a capital fund of 3.5 million yen was to be put at the disposal of the minister of interior, who was to use it primarily to protect and improve the major crafts and products peculiar to each region, and also to facilitate the development of internal transportation. The capital needed to improve various industries and encourage the manufacture of local products was to be provided within this framework. While projects listed in the third category were designed to increase production in general, seven high-priority endeavors relating specifically to transportation were also proposed. These were as follows:

(1) Construction of Nobiru port in Miyagi Prefecture: excavate a canal from the Kitakami River and build a port at Nobiru. Estimated cost: about 350,000 yen.

(2) Improvement of Niigata port. Estimated cost: 310,000 yen.

(3) Construction of road across the Shimizu pass: repair existing road linking Niigata and Gumma prefectures.

(4) Excavation of the Ōtani River canal: dig a canal between Kitaura Lake and the Hinuma inlet in Ibaragi Prefecture, tying the Ōtani River into Naka port. Estimated cost: 200,000 yen. Make plans for the improvement of Naka port sometime in the future.

(5) Conservancy of the Abukuma River: dredge and improve the Abukuma River. Excavate a canal link between the lower stream of the Abukuma River, the Shiogama inlet, and the new Nobiru port to facilitate transportation in the Fukushima region.

(6) Conservancy of the Agano River: facilitate transportation in the Aizu region of Fukushima Prefecture.

(7) Provision of transportation routes between the Imba swamp and Tokyo: link the Imba swamp in Chiba Prefecture with Kemigawa and then with Fukagawa and the Shin River in Tokyo. Estimated cost: about 200,000 yen.

The projects proposed in Ōkubo's letters of inquiry were to be carried out in this manner by Interior at a total cost of 6 million yen. Funds for each category were to be advanced on loan. It was expected that new industries would be financed by loans from the First National Bank. However, in the written report presented by Finance Minister Ōkuma on March 6, the same day Ōkubo tendered his proposals, it was recommended that all industrial development projects, including those initiated by the Interior and Industry ministries and the Colonization Bureau, be lumped together and that the total combined budget of 12.5 million yen be financed from a special fund raised by floating a government bond issue [8, pp. 131-34].

With regard to the March 6 proposals made by the ministers of finance and interior, the recommendations of the former were approved, and on April 30, 1878, Council of State Order No. 7 was promulgated transferring to him full responsibility for the procurement of public funds for industrial development. The First National and Mitsui banks took charge of handling the bond issue. The entire fund was to be raised by August 31 and the allocation of monies to each ministry decided by September. The funds were divided in the following manner. Interior and Industry received 4.2 million yen each, Colonization 1.5 million yen, and Finance 100,000 yen (to cover the cost of issuing the bonds) (see Table I).

Of the 4.2 million yen allotted to Interior, 1.2 million yen went to defray public works expenditures and 3 million yen for industrial promotion. Thus, many of the proposals included in Ōkubo's letters of inquiry of March 6 and 7 were implemented. The Nobiru project, in particular, was designated a public works enterprise of the highest priority, and by July 1878, work on it had already begun.

The construction of Nobiru port may be seen, then, as one of a series of key projects financed by public bonds as national development policies were beginning to take tangible shape under the strong leadership of Ōkubo, and, therefore, under the direct jurisdiction of the Ministry of Interior. With this in mind, I should next like to consider the necessity out of which the harbor project was born.

## II. THE PORT CONSTRUCTION PLAN

As the title of Ōkubo's first letter of inquiry indicates, industrial development and vocational aid for former samurai were integral parts of the same policy. They found concrete expression in the drainage works at Lake Inawashiro in Fukushima Prefecture and in numerous other projects designed to encourage rapid industrial growth, all of which were carried out under the authority of the Ministry of Interior and financed by industrial development bonds. These initiatives obviously belong to the policy of appeasement directed at disgruntled samurai whose frustrations peaked in the abortive revolt of the Satsuma fief. The intent

to mollify the remaining elements of feudal power as peace was restored after the Meiji Restoration was also plainly evident not only in the specific projects mentioned above but also in those funded by public bonds and delegated to the Ministry of Interior.

The fact that the government considered investment in the development of Tōhoku (northeastern Japan) and southern Hokkaidō, where resistance to the new order had persisted until the last, a national priority is indicative of its determination to pacify these regions. This was particularly true of Miyagi Prefecture, which includes the administrative district of the former Sendai fief. Official concern with the development of the Tōhoku region occasioned the first tour of the area by the Emperor Meiji in 1876. The imperial visit lasted from early June to the latter part of July. In May, Ōkubo, minister of interior, left Tokyo to inspect Tōhoku himself. Meeting the royal procession at Sendai, he proceeded on ahead of it thereafter and returned to the capital in July. Largely as a result of this tour, the construction of Nobiru port, the drainage works at Lake Inawashiro, and the reclamation of the Taimenbara plain were planned and incorporated into Ōkubo's report on industrial promotion.

Thus, the special policy objective of developing Tōhoku and the appeasement of dissatisfied ex-samurai were closely linked to the state's program of industrial promotion; both were given a more tangible dimension as part of the special projects administered by the Ministry of Interior.

The idea that the development of transportation was fundamental to the government's policy of encouraging industrial growth is found in various public documents. Indeed, the minister of finance himself viewed this effort as the "most pressing national task" of the state's publicly funded development projects [28]. Transportation-related projects were divided into two broad categories: the construction of port facilities for coastal navigation and the improvement of rivers and roads, under the authority of the Ministry of Interior, and the construction of railroads, the special responsibility of the Ministry of Industry. This division reflected accurately enough the state of internal communications and transportation at this period. For although the development of inland transportation called for the laying of railroads, rapid progress in this area could not be made for financial and technical reasons, and, as in the past, one had to rely primarily on roads and river transport. That is, railroad construction was in fact under way in some regions, but the government was still concentrating on linking internal transport with coastal shipping and on building new port installations to serve as hubs of the national transportation network it was creating. The state had set about strengthening the effectiveness of its industrial promotion policy by helping the Mitsubishi Company get started in the field of maritime transport and by consolidating coastal shipping and facilitating its integration into the inland transportation system. At the same time, it sought to recover from foreign steamship lines the exclusive rights and privileges these had acquired earlier. The new interest in ports was a sign that these efforts were at last beginning to pay off: it indicated that the consolidation of an adequate harbor system was becoming increasingly vital to the development of coastal navigation.

However, in order to accelerate the development of commerce and industry in line with its basic policy goals, the government found it necessary to shore up its financial base. Public financing had previously relied on taxes assessed in rice, but after the reform of the land-tax system in 1873, these duties came to be paid in cash. To effect this conversion, rice had first to be sold as a commodity and changed into money, and this transaction required the establishment of a rice market. Another essential condition for converting rice into cash was the creation of a stable price system. It therefore became necessary to provide for the regulation of the price of rice through a system of controls.

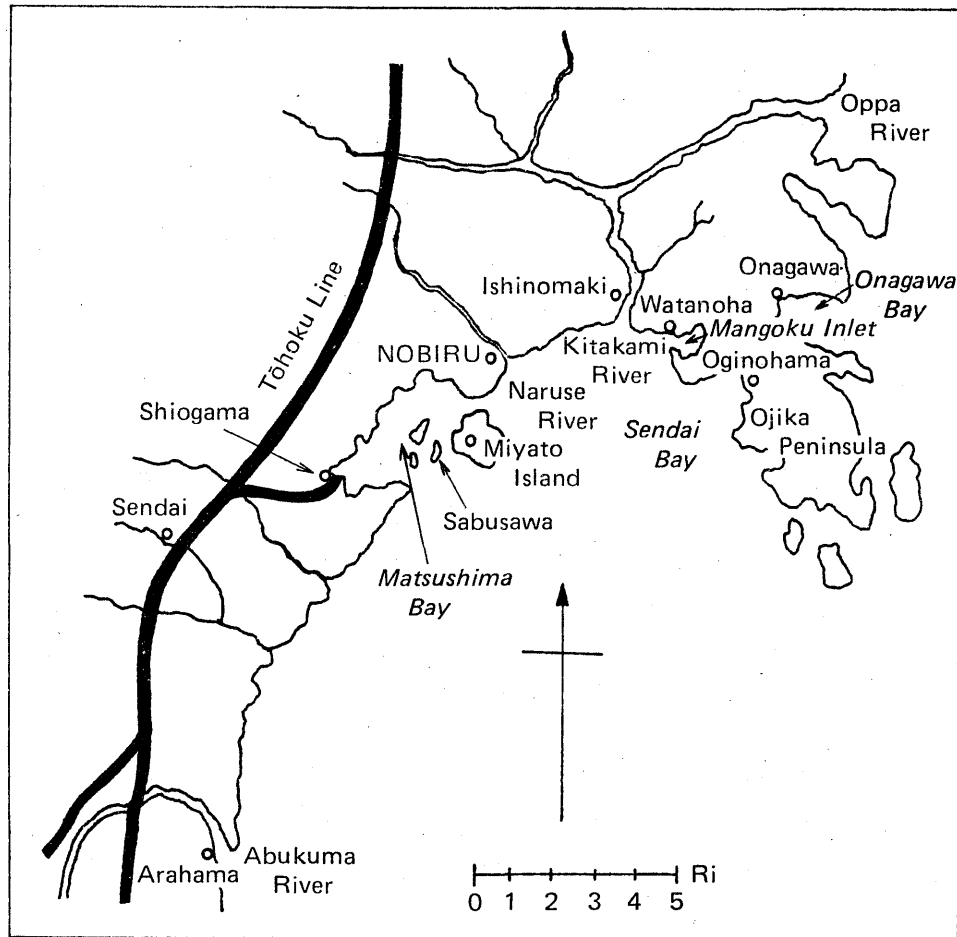
To this end, the government enacted the Rice Storage Ordinance in 1875, making the Accounts Office of the Ministry of Finance responsible for its administration, but in January 1877, it went one step further and decided to set up the Grain Reserve Bureau to deal exclusively with this program, formally inaugurating it in July 1878. One of the factors playing a large role in regulating the price of rice was the export of rice and wheat to overseas markets, an activity which was encouraged as a means of increasing foreign earnings. This program was part of the government's broader policy of encouraging private industry in an effort to "slow imports," one of the objectives of the industrial development plan.

It is at this point that Ishinomaki harbor, the most important in the Tōhoku region, enters the scene. Located in Sendai Bay at the mouth of the Kitakami River, about midway along Tōhoku's Pacific coastline, Ishinomaki had flourished as the principal port of the Sendai fief during the Tokugawa period (1603–1867). After the Meiji Restoration, Ishinomaki, which lay halfway between Tokyo and the newly colonized lands of Hokkaidō, grew steadily in importance. The major port of call for ships navigating the eastern maritime circuit, it occupied a key position in Japan's coastal transportation system. Its largest export commodity was "Sendai rice," the outstanding product of the Sendai fief.

Each year, Sendai delivered about 200,000 koku (i.e., 36 million liters) of its prized rice to Edo, the Tokugawa capital (later Tokyo) [17, pp. 433–37]. For this purpose, fief authorities kept ready forty-five granaries at Ishinomaki with a total storage capacity of 135,000 koku (24.3 million liters). The Nambu fief farther to the north, which transported its rice via the Kitakami River, also kept storehouses there. In March 1870, the Meiji government established the Ishinomaki Trading Company (which later became the Sanriku Company), in an effort "to promote trade and industry between regions by enhancing water transportation and to rapidly expand economic activities here," and entrusted to it the task of marketing all rice collected for taxes in the region [4].

The government thus showed considerable concern for Ishinomaki and its role as a storage and distribution center for Sendai rice. No doubt this explains why, in January 1877, Finance Minister Ōkuma in his decision to set up a grain reserve bureau designated Ishinomaki a key point (along with Tokyo, Osaka, Kobe, and Nagasaki) in the price control system for rice which was established at this time. Indeed, in October 1878, the government devised a scheme to buy up a total of 530,000 koku (95.4 million liters) of rice from the major collec-

Fig. 1. Nobiru and Its Surroundings



Source: Hiroi [2, Figure 1].

Note: One ri is approximately four kilometers.

tions points, beginning with Tokyo and Osaka, in order to raise the price of this commodity. According to the plan, 54 million liters, or about 60 per cent of the total, were to be purchased from Ishinomaki in order to “develop the transport of rice in the Rikuzen and Rikuchū regions [i.e., Miyagi and Iwate prefectures and part of Akita]” [9, p. 635].

In short, Ishinomaki was chosen as a port site because two major government concerns, the development of Tōhoku and the improvement of transportation there coupled with the need to regulate the price of rice to put state finances on a solid footing, were closely tied to the realization of national development policy.

However, Ishinomaki’s usefulness as a port of call for coastal vessels, which were growing increasingly larger in size, was gradually diminishing. This matter was described in detail in a report drawn up by Van Doorn,<sup>3</sup> a foreign specialist hired by the government. It records the results of a six-month survey of Ishinomaki harbor beginning in September 1876 at the request of Ōkubo, who had

<sup>3</sup> Cornelis Johannes Van Doorn (1837–1906), who was invited from Holland to supervise the government’s public works projects, stayed in Japan from 1872 to 1880. He surveyed and

returned from his visit to Tōhoku only two months earlier. Van Doorn indicated that at low tide, the level of the Kitakami estuary fell to below a depth of 1.8 meters. For this reason, he noted, ships of more than four meters draught when loaded were unable to enter the harbor and thus had to discharge their cargos at sea. It was also difficult for unloaded vessels to enter the port except at high tide due to silting at the mouth of the Kitakami River. Moreover, the estuary was frequently buffeted by violent southerly and southeasterly winds from the Pacific. At these times, ocean-going vessels were sometimes unable to leave the port for up to thirty days. For these reasons, the report indicated, the Kitakami estuary provided a poor outlet to the sea, and this factor vitiated the river's usefulness for navigation.

The first measure taken to rectify this situation was the improvement of the Kitakami debouchment and the construction of two jetties from the river's mouth to the sandbar that had formed in the estuary. These were designed to facilitate dredging operations and control silting. The cost of dredging the harbor to a depth of 5.2 meters was estimated at 180,000 yen. This was sufficient to enable Japanese ships to enter the port, but a depth of at least 7.6 meters was required to admit the large steamers which would call in the future. To maintain this depth, heavy expenditures and advanced technology were required, but even then, other ports would have to be found to accommodate the big ships. In this case, Japanese vessels would become the main cargo carriers; the inconvenient features of the harbor would result in a loss of time and in unnecessary expenses (the same shipment would have to be loaded and unloaded twice), increasing the risks and dangers already involved. Therefore, Van Doorn concluded, a more rational approach would be to abandon plans to improve Ishinomaki and look for a port or mooring in the vicinity able to make use of the Kitakami waterway.

In his conclusion, Van Doorn noted that although Orinohama (Oginohama) had been recommended by some as a possible alternative site, it, too, was unsuitable because it could not be connected to Ishinomaki by canal. Rather better, he advised, was the estuary of the Naruse River which was located about twelve kilometers to the west of Ishinomaki and which offered a sheltered mooring place and anchorage. A small island group blocked winds from the south, the water was deeper, the geological features of the region were well suited to the construction of harbor works, and a waterway could easily be dug out and run into the Kitakami River. For these reasons, Van Doorn urged, instead of improving the harbor at Ishinomaki, an entirely new port should be built at the mouth of the Naruse River.

The idea was to adhere strictly to the original plan of making the Kitakami River and Ishinomaki port more accessible by improving the latter, as both played a central role in the inland transportation system of the Tōhoku region. The plan, it was thought, could be most effectively implemented by building

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planned various riparian projects and the construction of ports, bridges, and breakwaters. The Asaka waterway project which drained water from Lake Inawashiro is noteworthy for its remarkable success.

harbor facilities at Nobiru and by establishing canal links between it and the Kitakami River.

The Nobiru port plan was also drafted by Van Doorn. A first phase included the excavation of the Kitakami canal (Kitakami River—[lock gate]—Takayashiki Village—Akai Village—Ōmagari Village—Fuka River—Naruse River) and the construction of an inner harbor at the Naruse estuary. A second phase consisted of the construction of moorings near Miyato Island just west of the debouchment to serve as an outer harbor.

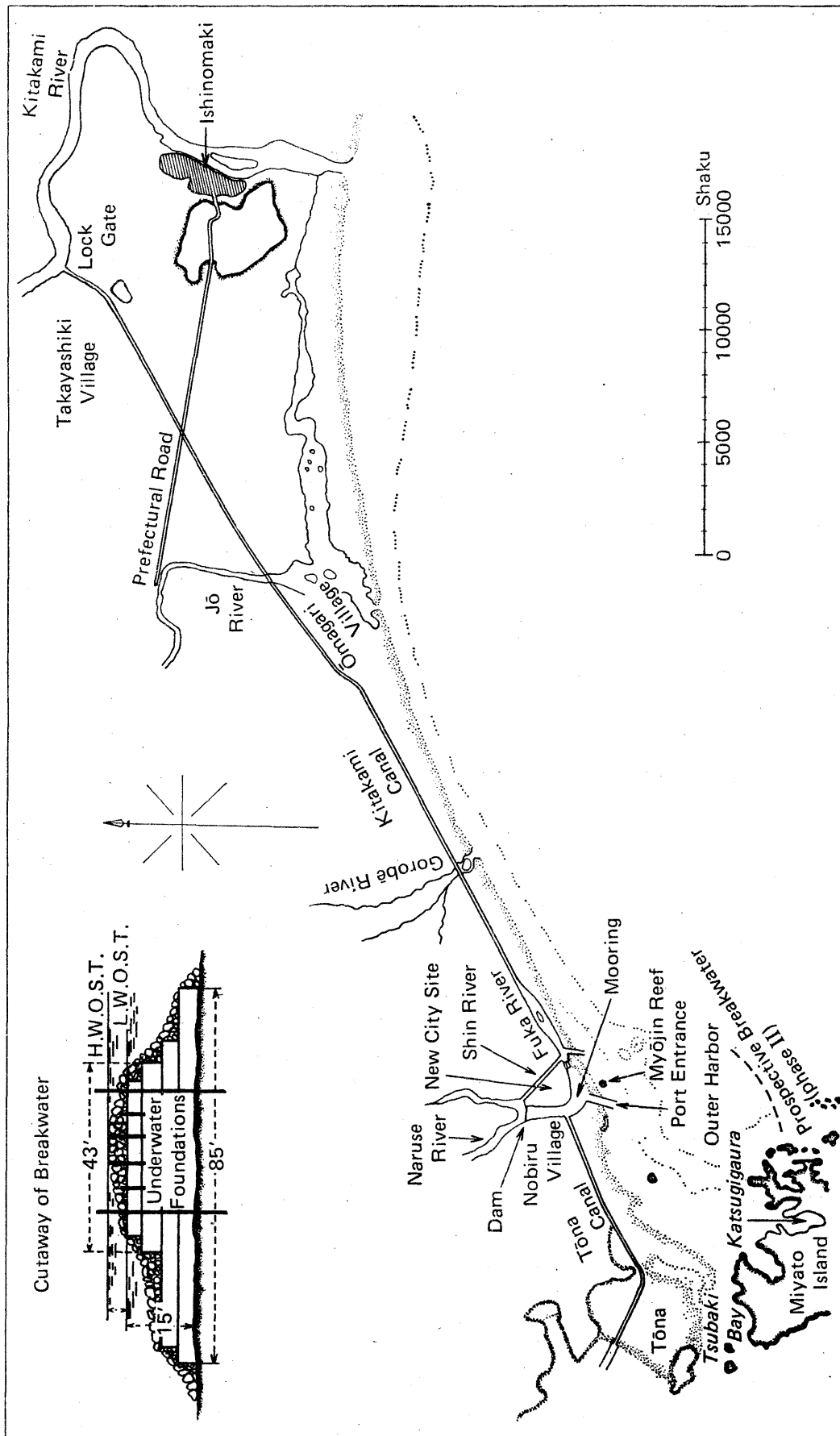
As the title of phase I ("Excavation of Canal from the Kitakami River to the Fuka River") indicates, the Kitakami canal and the inner port (i.e., the harbor formed by the Fuka River where it empties into the Naruse estuary, known as the Fuka River port) were to constitute the main part of the project. Secondary projects undertaken in connection with the first phase were to include the construction of a lock gate where the canal enters the Kitakami River and the relocation of the Naruse River's debouchment, which was to be shifted to the west to better protect the port entrance. (In fact, a reef, undetected by Van Doorn, blocked access to the port. This meant that the position of the outlet as described in the original plan had to be interchanged with the entrance. See Figure 2.)

The Kitakami canal was to be 14 kilometers long, 1.5 meters deep at low tide, and 9.1 meters wide (this was later changed to 10.6 meters). Along the canal bank, a tow-path for barges 2.4 meters wide and a road atop the embankment 3.3 meters wide for horse-drawn vehicles were provided for in the plan. Furthermore, the port entrance, built on the west side of the Fuka River and into which the Kitakami canal was to empty, was to be 4.2 meters deep at low tide. Its two breakwaters were to be set 91 meters apart and the entrance itself was to be 455 meters across. The port was designed to accommodate thirty Japanese ships. The eastern breakwater was to be 12 meters wide, the western breakwater 9 meters.

The port entrance construction method consisted of the following operations. Twigs, branches, and rocks were first piled up to lay the underwater foundation of the breakwaters. Boulders (about 200, each measuring 1.8 cubic meters) were next laid around the bed structure as ballast. The upper section of each barrier was formed by placing specially tailored rocks and capstones (0.75 cubic meters but more than 0.36 meters thick) on top of the upper layer of ballast rocks (1.5 cubic meters). The remaining spaces between capstones were then filled in with pebbles. Finally, to reinforce the entire structure, 250 square timbers (0.27 meters square, 6 meters in length) covered with copper plate and 300 ordinary logs (measuring 0.8 meters in circumference and 4.5 meters long) were pounded in around it. This was done for both the eastern and western jetties, but in the latter case, ordinary logs were not used and the method of construction was simplified.

The construction method employed was a unique Dutch one chosen by Van Doorn in his capacity as chief engineer. It was characterized by the use of twigs and branches. No other alternative technique had as yet been introduced in Japan. Furthermore, this method was then coming into wide

Fig. 2. The Plan of the Nobiru Port



Source: Hiroi [2, Figure 1].

Note: One shaku is approximately 30.3 centimeters.



use in riparian projects and was easily adapted to Japanese conditions. (However, while it was effective and economical in calm, shallow waters, it was not suitable for a harbor such as Nobiru which opened directly onto the sea and which lay close to deep coastal waters. The selection of this method for the construction of Nobiru port proved to be one of the greatest causes of the project's ultimate failure.)

Phase II of the project, the construction of the outer harbor, consisted of creating an anchorage adequately protected from the southerly and southeasterly winds. According to Van Doorn, vessels of 4.5 to 5.4 meters draught entering either the Fuka River harbor or the northwest side of Miyato Island would be sheltered from these winds naturally and would require no special protection. Should large steamers with a draught of 6 to 9 meters begin to call frequently at the port, they could probably find refuge from the southerlies on the north side of Miyato Island. In the event of typhoons and winds from the southeast, these vessels would be able to put in at Orinohama (Oginohama). However, Van Doorn remarked, should the loss of time and money involved in such maneuvers represent a major obstacle, a breakwater could be built at Miyato and nearby islets. This barrier would be 273 meters long (southwest to northeast), and, at the tip, its submerged portion would lie 9 meters below the water at low tide; it would be built of branches and rocks and would cost about 60,000 yen. Van Doorn wrote that he was eagerly awaiting the order to begin construction.

A cost estimate was appended to the plan for phases I and II according to which the initial stage would run to 171,000 yen, including an emergency fund of 10 per cent of the proposed budget. No breakdown of expenses for the second phase of construction was included, but its overall cost came to about 60,000 yen. The total budget, then, was roughly 230,000 yen.

Based on Van Doorn's plan and cost estimates, a manual of specifications was drawn up for phase I in March 1878 under the joint authorship of Tomohiro Hayakawa and Keitoku Kurosawa, both of the Public Works Bureau of the Ministry of Interior [31]. According to the project description, total anticipated expenditures were to exceed 255,544 yen, a figure 84,544 yen in excess of Van Doorn's original guess and representing an increase of close to 50 per cent. A comparison of the two plans shows only minor changes in the project design; the difference arises from an increase in the basic cost of materials and labor and from the fact that an emergency fund and outlays for machinery and tools not foreseen in the initial estimate were added on.

On March 21, 1878, on the strength of Van Doorn's survey report of February of the year before, Interior Minister Ōkubo submitted a written proposal urging the construction of a port at Nobiru; he decided to present a project description of the Miyato Island breakwater once the first phase had begun. Work was to be completed within two years. On April 4, 1878, permission was granted, and construction commenced on July 1.

### III. CONSTRUCTION OF THE NOBIRU HARBOR WORKS

Construction of Nobiru port began with the installation of the lock gate on the Kitakami River and the engineering of the Kitakami canal. In what follows, I shall attempt to retrace the progress of this endeavor (see [23]).

In August 1878, one month after construction began, high, gushing waters caused by a long rainy spell slowed work, and on September 9, the lock gate construction site was inundated and submerged by high waters which reached a level of more than four meters. Under the supervision of engineers, several dozen water pumps and rotary pumps were built to evacuate water from the site, occasioning heavy expenditures. This setback was compounded by a series of subsequent failures caused, among other things, by the appearance of cracks in the cement, of Japanese make, used to build the lock gate. In November, in the midst of these problems, 50 subcontractors and 2,000 laborers took their leave and construction came momentarily to a halt. Workers had to be recruited from the region along the Tone River and from Iwate Prefecture. The underwater construction was greatly hindered by the force of waves and by accumulating silt. Waves now and then eroded the underwater foundation of jetties, and the tips of the breakwaters were easily destroyed and washed away by the sea soon after their completion (see Figure 4).

These problems led to additional heavy capital outlays and were made worse by inflationary pressures. In September 1878, a rapid spiraling of prices began, and by April 1880 the cost of the project had increased by 77.3 per cent. Accounting for the inflated budget were the price of rice, which had gone from 4 yen to 8 yen per koku (1 koku=180 liters); laborers' wages, which had risen from 0.16 yen to 0.25 yen; and wages to skilled workers such as stone masons, carpenters, and smithies, from 0.25–0.30 to 0.45–0.55 yen, an average overall increase of 76 per cent compared to the cost in 1877. The cost of stone, timber, and other building materials escalated by 79 per cent. It therefore became extremely difficult to remain within cost boundaries, and despite serious efforts to restrain spending at the site, a request for an additional 107,807 yen, a sum equivalent to 42 per cent of the first budget, ultimately had to be submitted.

Yet other expenses were incurred. The width of the canal, originally to have measured 30 shaku (9.1 meters), was enlarged to 35 shaku (10.6 meters) in order to accommodate the wider Western steamships which were expected to navigate the passage. Furthermore, the discovery of a reef at the proposed harbor entrance meant that the entrance had to be shifted 180 meters to the west and a new outlet to the sea opened up at the site of the originally planned entrance, work which necessitated an extra outlay of 133,770 yen. These expenses, coupled with the budget overruns caused by inflation, raised the total bill sent to the government in April 1880 to 241,580 yen. The request for additional funds was granted in full on May 12, but it pushed total building costs to nearly twice their original level. Still the Nobiru budget continued to grow.

TABLE  
THE INDUSTRIAL

	Budget (Planned)	Additional Funds
Ministry of Interior (total)	4,204,915.191	-4,915.191
Nobiru port construction fund	255,544.855	288,130.210
Nobiru city land development fund (transferred item)	29,289.554	0
Niigata port construction fund	361,200.000	-339,597.194
Miyagi-Yamagata new road construction fund	89,854.716	11,750.000
Iwate-Akita new road construction fund	93,350.328	0
Construction fund for a road across the Shimizu pass	299,050.477	0
Lake Inawashiro drainage construction fund	—	—
Nasuhara waterway construction fund	22,707.000	34,801.793
Loan for the repair and construction of salt fields in Kagoshima Prefecture	53,918.261	0
Fund for industrial development (especially for former warriors and ex-warrior migrants)	3,000,000.000	0
Ministry of Industry (total)	4,261,204.000	-61,204.000
Kyoto-Ōtsu railway construction fund	1,333,914.000	-381,774.000
Tsuruga-Maibara (Ōgaki) railway construction fund	800,000.000	722,170.000
Land survey fund in preparation for the construction of the Tokyo-Takasaki railway	6,000.000	0
Ani mine excavation fund	} 2,001,600.000	-401,600.000
Innai mine excavation fund		
Aburato coal mine development fund	119,690.000	0
Colonization Bureau (total)	1,500,000.000	0
Horonai coal mine excavation fund	1,030,000.000	0
Iwanai coal mine excavation (innovation) fund	170,000.000	0
Steamship purchasing fund	300,000.000	0
Ministry of Finance (total)	100,000.000	0
Cost of issuing the industrial development bond	100,000.000	0
Grand total	10,066,119.191	-66,119.191

Sources: [8]; Hidezō Kitsukawa, *Meiji zaisei keizaishi kenkyū* [The financial and

## I

## DEVELOPMENT FUND

(Yen)

Budget (Determined)	Expenditures	Remarks
4,200,000.000	4,417,915.023	
543,675.065	678,194.245	Additional ¥241,580.21 in May 1880, ¥46,550 in 1882, and ¥134,519.18 in June 1882.
29,289.554	—	Determined on April 27, 1882.
21,602.806	21,602.806	Construction started in 1878, but halted in 1879.
101,604.716	101,604.716	Between Sakunami and Sekiyama. Construction began in 1880 and completed in 1882.
93,350.328	93,349.375	Between Kurosawajiri and Yokote. Construction began in 1880 and completed in 1882.
299,050.477	347,015.174	Construction began in 1881 and completed in 1885.
—	427,100.198	Construction began in 1879 and completed in 1882.
57,508.793	22,707.000	Construction began in 1880 and completed in 1882.
53,918.261	53,918.261	Determined in December 1880.
3,000,000.000	2,672,423.248	
4,200,000.000	6,042,601.001	
952,140.000	952,140.000	Construction began in 1878 and completed in 1880. Construction cost was ¥730,074.677. The remainder was transferred to the Railway Bureau in 1885.
1,522,170.000	3,421,469.000	Construction began in 1880. Changed the original plan in 1882. The railway was completed in 1883 as far as Sekigahara, and in 1884 as far as Ōgaki. Construction cost was ¥2,878,127.069.
6,000.000	5,974.805	Construction began in 1880. In 1881 transferred to the Japan National Railways.
1,160,000.000	1,138,208.898	Sold to Furukawa Co. in 1885.
440,000.000	476,200.000	Sold to Furukawa Co. in 1885.
119,690.000	48,608.298	Sold to Shirase Co. in 1884.
1,500,000.000	1,805,165.809	
1,030,000.000	1,649,623.905	Of which excavation fund is ¥219,086.851 and railway construction fund is ¥1,430,537.054.
170,000.000	155,541.904	
300,000.000	0	
100,000.000	99,988.030	
100,000.000	99,988.030	
10,000,000.000	12,365,669.863	General account, ¥1,851,405.864; Nakasendō railway public bond, ¥458,274.000; industrial development capital fund, ¥55,989.999.

economic history of the Meiji era] (Kyoto: Hōritsu-bunkasha, 1969).

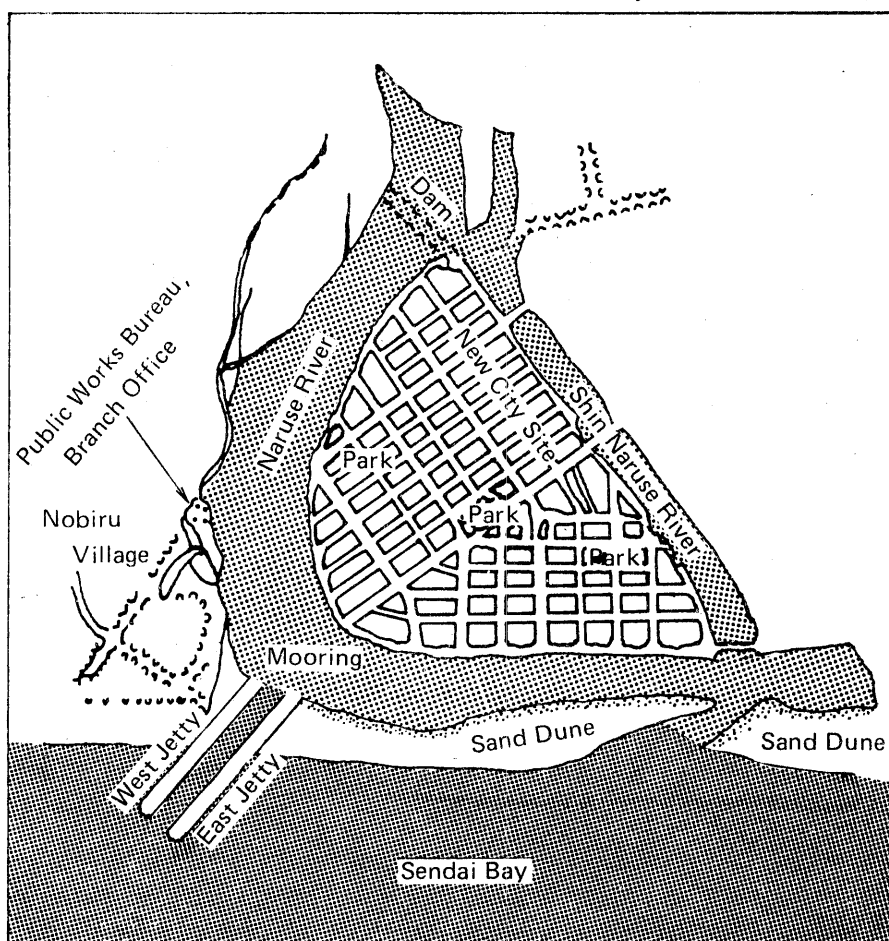
On April 27, 1882, the Ministry of Interior decided to dip into the industrial promotion fund to pay 46,550 yen in travel expenses to the officials responsible for the project [21], a sum which until then had been covered by the construction budget. When this amount is added to the cost of developing the Nobiru city site (134,519 yen), total expenditures for the project come to 678,194 yen (see Table I).

But despite budgetary and other difficulties, work on the port facilities went forward. Three steam-run dredgers, each capable of moving forty tons per hour, were imported from Holland, and six hand-operated water pumps were brought into use, and by late 1882, with the exception of the dredging of the anchorage and the development of city land, 70 per cent of the construction had been finished, and final completion of the project was only a few months away [25].

However, as the initial phase of construction was in progress, a number of new but related projects became necessary. The first of these was the disposal of waste water trapped during the excavation of the Kitakami canal as its construction cut across smaller waterways. This involved the excavation of two ditches, one on either side of the canal, stretching from the lock gate to the Jō River, each about 8 kilometers long, 1.8 meters wide, and 1.7 meters deep. From the Jō River to the Gorobē River, a similar trench was to be dug to a length of 4.75 kilometers on one side of the canal only. The ditches were not included in the original plan, but their construction was nonetheless necessary, and at the request of Masanao Matsudaira, governor of Miyagi Prefecture, it was decided to excavate the trenches together with the canal and finance both out of public funds at a cost of 9,696 yen. The project was to be placed under the direct supervision of the Ministry of Interior [15].

In late 1882, as the Kitakami canal and Nobiru port were nearing completion, the problem arose of linking Nobiru to Matsushima Bay. As noted earlier, this question had been discussed in connection with the improvement of the Abukuma River, a category III project outlined in Ōkubo's letter of inquiry of March 6, 1878. The Miyagi Prefectural Assembly also had made strong representations to the government along these lines, and it was therefore decided to link the two points by canal. Miyato Island was not then attached to the mainland, and the narrow channel that separated it from land, known as Tsubaki Bay, constituted the normal navigation route between Nobiru and Matsushima Bay. However, with each passing year, this channel had grown shallower as silting gradually choked it off, until it was no more than 60 centimeters deep; within a few years' time, it would have disappeared altogether. In December, the interior minister decided to ask authorization to put through a canal there, and a proposal to that effect was accepted by the government on February 21, 1883. The estimated cost was 87,000 yen. To raise this sum, 20,000 yen was to be reallocated from the Nobiru port budget together with 23,000 yen (from fiscal year 1882) of the 50,000 yen earmarked for improving the Kitakami River. An additional 30,000 yen from the same source was to be made available in fiscal year 1883 plus 14,000 yen left over from the construction of a

Fig. 3. The Nobiru Port and City Site



Source: Takahashi [32, p. 231].

breakwater in Sakai harbor. But the diversion of funds from the Sakai port budget was not authorized, and the canal plan was ordered into effect with a budget of only 73,000 yen [25]. However, as a result of an agreement arranged by the interior minister in December 1883, the government allowed the disbursement of 14,000 yen from a 200,000 yen fund set aside for improving the Abukuma and six other rivers. Work on the Tōna canal, as it was called, was begun with a total budget of 87,000 yen as originally provided for and was completed in 1884. It was 3.2 kilometers long, being built to the same dimensions as the Kitakami canal (i.e., 10.6 meters wide, 1.5 meters deep) [6].

As work on Nobiru harbor progressed, the problem of developing a site for Nobiru city surfaced. The basic issue was this: if the settlers had to bear the financial burden of developing municipal land and facilities themselves, the costs being heavy, the port would not attract large numbers, and the heavy state investment in the harbor project would be in vain. However, if, to circumvent this difficulty, the government serviced the city itself, divided it into lots and then sold these off to settlers, it could kill two birds with one stone. For this purpose, it was decided to improve 331,000 square meters of public land for habitation, of which 148,830 square meters, when sold at 2.5 yen per tsubo (1 tsubo = 3.31 square meters), would bring in 112,411 yen. Thus, putting the

expense of developing the land at 71,624 yen, this would leave an additional 40,787 yen over and above costs, which would be incorporated into the Nobiru budget. On May 19, 1881, the plan was proposed, and permission was officially granted on August 6 of the same year [24].

Later, in April 1882, a request was drawn up asking the government to allow the diversion of up to 70,000 yen to the city development fund until such time as the land had been auctioned off. The money was to be drawn from the 1.2 million yen public works budget included in the industrial development fund and administered by Interior. The request announced that, as of that date, the city project had cost a total of 134,519 yen. However, as there was in fact only 29,289 yen remaining in the public works fund, the transfer of this amount alone was authorized [27]. Later (just when is unclear), the diversion of 134,519 yen was allowed from funds allocated for the construction of a road over the Shimizu pass, itself an industrial development project overseen by Interior. However, the sale of developed city land, which began on April 1, 1883, proved to be a complete failure, and on April 10, a report was forwarded to the government warning of difficulties in reimbursing the Shimizu fund out of the receipts from projected land sales at Nobiru. On June 21, it was therefore decided to recover this money from other sources in the course of fiscal years 1883 and 1884 [26].

When the construction of phase I and associated projects was completed in 1884, total costs had soared to 774,890 yen. This included expenditures of 96,696 yen for the Tōna canal and the drainage ditches along the Kitakami canal, which, while they were not part of the original design, proved in the end to be necessary, and 678,194 yen spent on the Kitakami canal itself and on the Nobiru harbor works (including the improvement of city land). When construction finally came to an end, the project had lasted nearly six years instead of two, and its costs had risen from 250,000 yen to an amount more than three times that.

#### IV. REGIONAL DEVELOPMENT PROJECTS

With the implementation of secondary projects undertaken in connection with the construction of port facilities and the Kitakami canal, the Nobiru project gradually expanded into a much broader regional development program. Nobiru port, the heart of the plan, was connected not only to the Kitakami canal but also to the Abukuma River system via a network of waterways (Tōna canal, Matsushima Bay, Teizan canal), and as these and other small and medium waterways and roads were improved, the entire region underwent rapid development. This may be seen as one lasting achievement of the national development policy imposed by the government from above.

The Ministry of Interior decided in 1878 to build new roads and improve existing ones leading to Nobiru port as a public works project financed out of the industrial promotion fund. This involved two initiatives. The first was the cutting of a new road between Sakunami in Miyagi and Sekiyama in Yamagata linking the two prefectures. The second was the opening up of a road

between Kurosawajiri in Iwate Prefecture and Yokote in Akita, linked to the Kitakami River. Agreement to construct the Sakunami-Sekiyama route had been reached in March 1878 by the governors of Miyagi and Yamagata, Jiryō Miyagi and Michitsune Mishima. They had submitted a report on the project, requested authorization to proceed, and asked for public funds to build the tunnel section of the road. On May 13, the government ordered that a project description and an ordonnance map based on a preliminary survey of the proposed route be submitted as well [8].

However, both prefectures had to make many subsequent applications before permission to proceed with construction of the road was finally granted. The project was approved on June 1, 1880, on the basis of an inter-prefectural agreement and with a general budget of 89,854 yen. Work got under way on July 1, but the funds were not adequate to cover the costs incurred between July and August of the following year, and at that time both prefectures requested an additional outlay of 14,570 yen, which was finally allowed in July 1882. The project was completed on September 3 of the same year [29]. The fact that the Sakunami-Sekiyama project was not a direct initiative of Interior but was conceived and executed by the two prefectures working in collaboration gives one some idea of how very difficult it was to obtain the necessary funds and carry the plan through to completion. The project was nonetheless a success. In *The Historical Documents of Miyagi Prefecture*, we find a clear and concise description of the great influence the road came to exert on regional trade: "Not only pushcarts carrying goods but rearcarts as well, large and small, can now travel freely from Sendai to Yamagata. Thus, freight traffic has quickened, and trade between the two regions has greatly expanded, thereby naturally laying the basis for the prosperous development of local products" [29].

In addition to projects planned and funded under the industrial development plan were many others carried out by the individual prefectures themselves, such as those undertaken by Miyagi Prefecture. Regional initiatives proliferated after 1878 when the law creating the prefectural assemblies was enacted. With the convening of these bodies, development plans were worked out in conjunction with the orientation of prefectural policy. The second tour of Tōhoku by the Emperor Meiji in August 1881 also served as a powerful stimulus to the further development of the region.

On August 13 and 14, 1881, Shigeyuki Masuda, then speaker of the Miyagi Assembly, met with Prince Arisugawa and State Councillor Ōkuma, both of whom had inspected Nobiru and Ishinomaki on behalf of the emperor, and spoke to them of a number of proposed prefectural projects, receiving their endorsement. Documents in support of these plans were prepared and presented to Ōkuma in September. These were divided into four basic categories according to the source of funding proposed (i.e., local taxes, national funds, prefectural bonds, and voluntary contributions) and included nineteen items [10].

One of the proposals, to be financed by prefectural bonds, remains with us, the "Position Paper on the Development of Industry in Miyagi Prefecture" [16]. According to this document, a sum of 1 million yen was to be raised between



April and June 1882, and five major projects were to go into effect, including the excavation of a canal linking the Kitakami and Abukuma rivers from a point midway between the two waterways. The request to float a prefectural bond issue to finance these undertakings was submitted to the Ministry of Interior by the Miyagi prefectural authorities on March 30, 1882, and on April 12, the order was given to subscribe for the bonds, contingent upon the agreement of the Prefectural Assembly [12]. However, opposition to the bond issue inside the prefecture was strong, and the question was shelved without having been put before the Assembly.

The industrial development plan backed by prefectural bonds was never realized. The following year, however, the ordinary session of the Prefectural Assembly decided to approve several of the projects that had come under discussion. These included five schemes involving the repair and improvement of prefectural roads and two pertaining to the conservancy of the Teizan canal and the dredging of Matsushima Bay. Total expenses for the seven projects were set at 684,600 yen. It was decided to raise two-thirds of the funds (456,400 yen) from prefectural tax revenues and a special council fund and the remaining third (228,200 yen) with the aid of the central government. The projects were to be completed within seven years.

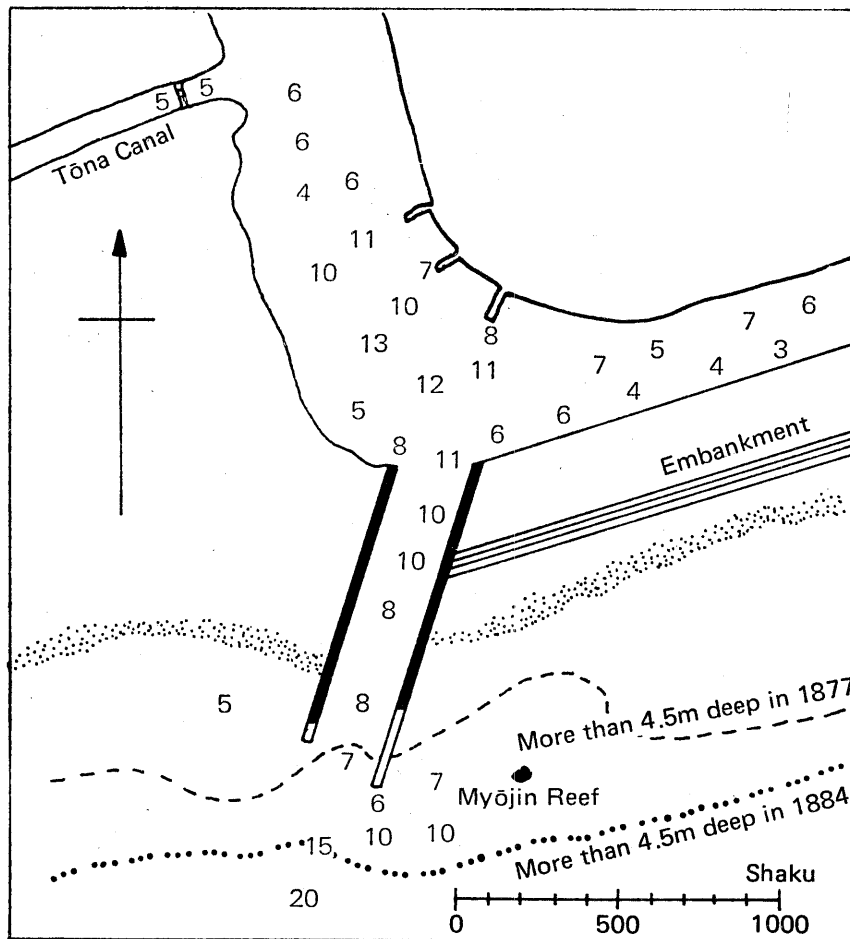
The report submitted by the prefecture to the government indicated that the improvement of both land and water routes converging on Nobiru and linking Morioka, Akita, Yamagata, and other areas had created a major transportation artery connecting the seven regions of Tōhoku, but, the report stressed, a system of smaller connecting links between the major waterways and thoroughfares was needed to pull the network closer together. In response, the government decided on June 18, 1883 to give Miyagi assistance financially and ordered work on these projects to begin. Of the 527,300 yen remaining out of a total budget of 684,600 yen (i.e., after 157,300 yen had been withdrawn for the proposed improvement of the Onikōbe pass in northwestern Miyagi near Akita), one third (175,766 yen) was made available to the prefecture from government coffers [11].

Thus, a transportation network centered on Nobiru was built up, and regional development projects undertaken in connection with this effort were begun one after the other. On November 30, 1882, at the suggestion of Masaru Inoue, chief of the Railway Bureau, a survey of possible rail lines running from Nobiru through Sendai as far as Fukushima was approved and the task entrusted to the Japan Railway Company. However, Nobiru did not fulfill earlier expectations and failed to prosper as a port. This was demonstrated in an extreme form by the auctioning off of city land after April 1, 1883. Inability to sell this land was, according to local authorities, due to "the fall of rice prices and the bad economic situation," but the basic reasons lay elsewhere.

## V. THE OUTCOME OF THE NOBIRU PROJECT

Aritomo Yamagata, minister of interior from December 1883, inspected Nobiru

Fig. 4. The Entrance of Nobiru Port in 1884



Source: Hiroi [2, Figure 1].

- Notes: 1. One shaku is approximately 30.3 centimeters.  
2. Note that the tips of the two breakwaters had been washed away by 1884.

port in November 1884 and recorded the following impressions of his visit, here summarized [22]: The project is basically finished, Yamagata wrote, and we are awaiting the arrival of merchants and tradespeople to settle the city, but, as yet, no shops or buildings crowd the streets. This is because the land faces the southeast from which a strong prevailing wind blows constantly, he explained. As a result, Nobiru does not offer a suitable mooring to large ocean-going vessels, and goods shipped the area go rather to Oginohama; almost none arrive in Nobiru. Therefore, merchants are reluctant to open stores here, there are no permanent inhabitants, and the situation is such that some think the great port project itself to be a wasted effort. For these reasons, he concluded, prompt countermeasures must be taken.

A map based on the 1884 survey shows that by this time the accumulation of heavy silt deposits at the entrance to the port had already reduced the harbor's depth considerably [2] (see Figure 4). Water off the tip of the east breakwater was no more than 1.8 to 2 meters deep, less than half of the 4.5 meters called for in the original design, and the required depth was receding farther out to sea with the passing of time. Furthermore, because the second phase of con-

struction, i.e., the building of a breakwater in the vicinity of Miyato Island which Van Doorn had urged, was never begun, large ships anchoring in the port could find no protection from the prevailing winds, making the handling of cargo an impossible task. Therefore, only small ships with a draught of about 1.5 meters and able to negotiate the Kitakami and Tōna canals were capable of using the harbor. But even small craft bringing cargo to the port for transshipment or to pick up goods had no reason to use the inner port if connecting vessels plying the coastal routes could not enter. In neither instance, then, could Nobiru fulfill its proper function as a harbor.

In view of the situation, it is understandable that people connected with the harbor should hesitate to settle there. Nonetheless, in September 27, 1884, Tsugumichi Saigō, minister of agriculture and commerce, reported to Prime Minister Sanjō that the establishment of a rice trading center at Nobiru had been approved based on the prognosis that, in the future, the port would become an "important center for the transport of rice" [20]. But eight months later, on May 5, 1885, Saigō had to report again to the prime minister that, at the request of the governor of Miyagi, he had authorized the temporary transfer to Ishinomaki of the Nobiru rice center, which however, retained its original name [13].

Given this situation, one may well imagine that the conclusions reached by Yamagata concerning the future of Nobiru port in 1884 were of great importance for the future of the region. His final account of the port was sent to Prime Minister Sanjō on June 2, 1885 [22]. Yamagata based his conclusions largely on the results of a survey conducted by a six-man team whose members included Rouwenhorst Mulder, a foreign engineer hired by Interior; Engineer Third-Class Torakichi Yamada, also of Interior; Navy Commander Tsuboi; Public Works Bureau Chief Mishima; Captain J. M. James of Kyōdō Transport Company; and Captain T. H. James of Mitsubishi. In their opinion, it was essential that a breakwater be built at Miyato Island to provide protection from the southeasterly winds if the port were to function as intended. But the 273 meter structure recommended by Van Doorn was insufficient; it would require a barrier 1.82 kilometers long built at a cost of 2 million yen (as opposed to Van Doorn's 60,000 yen) to do the job, they said. Chances of successfully completing the project were nonetheless slight, and the heavy volume of silt carried by the Naruse River meant that there was always a danger of the breakwater silting over. Therefore, Yamagata noted, Onagawa Bay would provide a better harbor site. To excavate a canal linking this area to the Kitakami River and canal system would only cost 600,000 yen. In terms of time and money, it was clearly more attractive to build a port at Onagawa than to construct a breakwater at Miyato Island near Nobiru. The report submitted by Yamagata concluded by requesting the construction of port facilities at Onagawa, reasoning that more was to be gained by using the installations already available at Nobiru while transferring the center of port operations to Onagawa. Yamada drafted the plans on which Yamagata's findings were based, and the recommendations made by Mulder constituted the core of the report; Mishima's insistence that Nobiru port should be completed as originally planned was not heeded.

In reply to this proposal, the preparation of a financial estimate based on a detailed on-site survey was requested on July 4, 1885, and the Onagawa port plan took its first concrete step toward realization. At that point, the interior minister had Yamada undertake the survey and draw up a budget for the project, which he submitted three months later, on September 30. The overall cost of the endeavor was put at 784,981 yen [14]. The plan was roughly as follows. Onagawa Bay lies east of the base of Ojika Peninsula. It was proposed to tie Onagawa into the Shiogama Bay farther to the west via a series of canal links. The first leg of the route was a canal 14.5 meters wide and 2.4 meters deep to be constructed between the bay and the Mangoku inlet. The Mangoku inlet would be dredged and tied into the Kitakami River via another canal to start from Watanoha at the western extremity of the inlet. From there, the route led to the Kitakami canal via yet another canal to be excavated between Ishinomaki and the Jō River. West of this point, it would pass through Nobiru, the Tōna canal, and Matsushima Bay until it reached Shiogama.

Directives were issued in response to this proposal on November 20, 1885, and while its basic recommendations were accepted, the authorities hesitated to commit themselves to a construction deadline, urging "as much discussion and review as possible, given the state of public finances." The interior minister's report on the Onagawa project was forwarded to the government in January 1886 and again in July [30]. In it, the minister noted that to move ahead with work on the harbor, the Miyagi Prefectural Assembly had voted to cover one third of the total budget of 780,000 yen, or about 250,000 yen, through prefectural tax receipts and had forwarded a report to this effect to the central government. Upon receiving this news, the minister's account continued, he decided to contribute the remaining two-thirds of the costs, about 530,000 yen, from his public works budget and informed the government of his wish to complete the project within three years (of 1887).

The following year, in 1887, the canal section of the plan was done away with and the design modified to provide a direct rail link between Onagawa and Sendai by extending a branch line to the port from the main Tōhoku trunk line. On May 18, the head of the Railway Bureau received orders to conduct the necessary land and cost surveys. This change was critical. It meant that even were the Onagawa port to be constructed, the plan to connect it to Nobiru by way of canal so as to be able to utilize the harbor works and related port facilities already built there became meaningless and had to be abandoned. The final blow was thus delivered to the Nobiru port project whose construction had occupied planners since 1876.

The Onagawa plan was later dropped in its turn, and the construction of a port there was never realized. In December 1887, a railroad was put in between Shiogama and Ueno in Tokyo, but a line was not extended from Shiogama to Onagawa until October 1939, some fifty years later. The construction of Nobiru port, the central part of the Nobiru project, thus ended a total failure, but each of the related canal works, including the Kitakami and Tōna projects, may be adjudged a success. As a result of these initiatives, the entire Tōhoku region

was linked directly to Sendai Bay, and in place of Nobiru, Shiogama, which had since evolved into a modern port, came to play a leading role in the development of regional maritime trade.

With the opening of the Tōhoku line between Ueno, Shiogama, and Aomori in the north in September 1891 (the line ran inland but more or less parallel to Tōhoku's Pacific coastline), roads and waterways upon which transportation had once depended exclusively now gave way to newer forms of conveyance, greatly enhancing the importance of Sendai Bay and Shiogama as centers of regional commercial activity. We see here the fruits of the government's close attention to the development of Tōhoku, a concern standing in direct relation to its policy of promoting industrial growth via the national development plan.

The inauguration of the Tōhoku line brought about the quick decline of river transportation which, it had been hoped at the inception of the Nobiru plan, would be integrated with coastal shipping. For example, between 1886 and 1899 (the period of time during which the Tōhoku line was built), the volume of freight carried by riverboat on the Kitakami, Naruse, and Abukuma rivers fell, respectively, to 64.5 per cent, 56.5 per cent, and 20.2 per cent of the 1886 figures [7, p. 162, Table 3-1]. In the case of the Abukuma River, the volume of cargo transported dropped dramatically, by 80 per cent, during this period, a fact which attests to the rapid conversion from water to rail as the primary means of inland transport. This transition signaled as a matter of course the decline of the ports located at the mouths of these three rivers (i.e., Ishinomaki, Nobiru, and Arahama), and the Kitakami, Tōna, and Teizan canals connecting the three ports also fell gradually into disuse. There was, then, an important difference between two types of port with respect to the factors which made for development. Some ports were located at estuaries and had in their hinterland only internal river systems. Others, such as Shiogama, centrally situated on an axis between Tokyo and Aomori, were able to draw on a vast inner territory reaching from Kantō to Tōhoku. The displacement of overland and river transportation by the railways as the major form of internal travel effected a shift from coastal navigation, closely tied to estuary-type ports and dependent on river transport, to coastal shipping operating out of seaside ports and relying on rail traffic. This transition hastened the decline of the traditional river mouth port.

The location of Shiogama harbor, which replaced Nobiru, appears to have given it a decisive advantage over the latter when the Japan Railway Company began unloading materials there in 1886 for use in the construction of the Tōhoku line. However, in 1882 a decision was made, it will be remembered, to run a survey for the laying of a rail line between Nobiru and Fukushima via Sendai; the collapse of the Nobiru project itself, then, must be seen as the basic reason for Shiogama's prosperity.

What were the causes of the Nobiru failure? Isamu Hiroi has addressed this question, as summarized here, in the postscript to his *History of Japanese Port Construction* [2]. In the first place, Hiroi begins, when Nobiru was selected as a port site, the absence of cities in its hinterland, an economic factor, was not

taken into account. Second, the government attempted to complete the port with a mere 500,000 yen. Third, errors in project design were committed due to a lack of technical experience. In more concrete terms, Hiroi cites the following points. (1) Van Doorn was by training an engineer specializing in river works; his experience with port technology was not extensive. (2) The preliminary survey of the Nobiru site was incomplete and inadequate. Specifically, a reef was discovered at the harbor's entrance after construction had already begun, making it necessary to amend the original plan and transfer the mouth of the port to the western side of the harbor. Nor was attention paid to the problem of silting and drifting sand; indeed, it was ignored altogether. These were the most serious mistakes. (3) The construction of the outer harbor (phase II) was never taken seriously. While the construction of a breakwater was held to be essential, a barrier somewhere between 0.3 and 1 kilometer in length was thought to be sufficient, and a budget of only 60,000 yen was considered adequate for its realization. (4) The breakwater itself was built by simply piling small bits of stone and rubble mixed with hardened clods of earth on top of a submerged base structure several layers thick. This raises serious doubts about Van Doorn's competence in the area of port construction technology. Citing these specific examples, Hiroi, then, places blame for the project's failure squarely on errors in planning and design, implicitly pointing to Van Doorn.

The answer to what led to the Nobiru failure is somewhat more complex, however. The preliminary survey is obviously the most important element in a port construction plan. This normally consists of two things: an economic survey conducted to determine the economic viability of the project and a survey of the natural conditions at the proposed site. Based on the preliminary survey, technical planning proceeds and a master plan is drawn up. The truth of the matter is that in this respect the Nobiru project was not quite up to standard and that political motives were allowed to intrude and take precedence over other concerns. For this reason, the geological conditions at the site were eliminated as a factor of consequence, and little regard was paid to the economic effectiveness of the enterprise as a whole. But in the final analysis, the most compelling single factor in explaining why Nobiru was unable to assume its proper function as a port lies, I think, in the technical side of the project and particularly in the use of foreign methods ill-suited to Japanese conditions.

Of particular note in this context is the fact that while Japanese engineers looked to Holland for technical aid in the form of the machinery they imported and used in the project, the Japanese side was ultimately responsible for the actual construction itself. There were two reasons for this. The first was that canal excavations and the conservancy of rivers were major aspects of harbor construction, and this meant that existing, endogenous techniques were largely adequate for the task at hand. A second reason was that Dutch breakwater techniques had already been used by Dutch engineers in Japan on riparian projects, and Japanese experts had acquired considerable experience in their application. Moreover, this technology was not in itself particularly difficult to master.

For these reasons, although he drafted the project design, Van Doorn was not

ultimately accountable for it. This responsibility belonged rather to Shōichirō Ishii, chief of the Public Works Bureau, Ministry of Interior. Tomohiro Hayakawa and Keitoku Kurosawa of the same department prepared the prospectus for the port project under Ishii's supervision. A comparison of Van Doorn's written estimate of February 27, 1877 with the project description drafted by Hayakawa and Kurosawa in March 1878 reveals a fair number of discrepancies, as, for example, the addition of new sections to the initial plan and the computation of unit costs. These concern mainly budgetary items. But the increase in construction costs indicated in the memorandum submitted in March 1880 which was also based on estimates supplied by Kurosawa, was in reality due to sweeping changes made in the basic design itself. These included the relocation of the harbor entrance and breakwater, but, in February of the same year, before the report was submitted, Van Doorn resigned from his post. This fact forces us to conclude that responsibility for the decision to implement these projects lay primarily with the Japanese.

Furthermore, Van Doorn did not devote his entire energy to one project alone but was simultaneously involved in several; he does not therefore appear to have borne complete responsibility for all the projects in which he was involved. In April 1878, before work on the new port began, Van Doorn set out for Nobiru, but from November 1878 to January 1879, he was occupied surveying and planning the work at Lake Inawashiro in Fukushima Prefecture: the Asaka waterway project which was successfully completed in 1882. Then, in February 1880, with the Nobiru project in full swing, and despite the fact that the Inawashiro operation had just begun, he tendered his resignation and returned to Holland. In the light of these facts, one may conclude that although Van Doorn was chief engineer, and while he conducted surveys for each project, drafted the early plans, offered guidance, and made recommendations, he did not, in the end, exercise decision-making power or have final say over any of them. From this standpoint, the original design was modified on the judgment of the Japanese side; Van Doorn was not solely accountable.

In summary, the failure of the Nobiru plan may be traced to the fact that faced with a major construction project for which they lacked adequate experience, Japanese specialists turned to the Dutch methods with which they were already familiar and which appeared to be easily adaptable to the Nobiru plan. Moreover, the foundation necessary to receive other more advanced technologies did not yet exist in Japan. However, as Hiroi points out, despite this early setback, the varied experiences that grew out of the Nobiru project provided many valuable lessons which were later put to good use on other national development programs [2, p. 35].

It was during this period that Dutch engineering and riparian technology exerted their greatest influence in Japan; Japanese technicians with foreign training had not yet come on the scene. Torakichi Yamada, who later drafted the plans for the Onagawa port by himself, returned from his studies in France in 1876 and entered the Ministry of Interior. Working under the guidance of Van Doorn, he assumed primary responsibility for planning the Inawashiro project

in 1879. Other examples of Western-trained specialists are Kimitake Furuichi, who upon returning from his studies in France in 1880, entered the Public Works Bureau at Interior, and Tadao Okino, who left France in 1881 and joined the bureau in 1882. Thus, civil servants with technical backgrounds having studied engineering and riparian technology abroad returned home to work for Public Works, attaining positions of leadership and responsibility and gradually replacing Dutch engineers. Van Doorn arrived in Japan in 1872 and left in 1880. This ten-year period saw an important transition in the world of Japanese technology, which changed its orientation from an emphasis on riparian and harbor works based on Dutch-style shallow-water techniques to deep-water technology. Conceived at midpoint in this transition, the Nobiru project, planned and carried out using Dutch technology and engineering principles, was ultimately branded a failure.

## CONCLUSION

In this essay, I have examined the construction of Nobiru port and its associated development projects in their relation to the industrial promotion policy formulated by Toshimichi Ōkubo in the early Meiji period. I would now like to think about the meaning of the results obtained. The first task is to sort out the various designs that lay behind the planning and execution of the project. These may be divided roughly into two types. One area of official concern was the creation of a national transportation network, another the establishment of a system of regional transport with a view toward promoting economic development at the local level.

The Nobiru plan, devised as one strategic link in a national transportation network, relied on internal transport and therefore placed special emphasis on developing coastal and inland water routes capable of supporting long-distance shipping and heavy freight traffic. Overland routes were to be put through as a supplementary measure. Thus, ports at estuaries were to be developed as the hub of a water transport system, tying coastal shipping into inland waterways and thereby completing the national network. To put the finishing touches on the system, regional transportation routes were to be improved or created, encouraging regional development. This was necessary to protect and foster the manufacture of important local products and to promote regional economic growth. The construction of the local as well as national systems was the aim of the development projects associated with the Nobiru plan. To summarize, then, the fundamental objective of the Nobiru project was to lay the groundwork for the realization of the government's industrial development program by serving as a catalyst for the creation of a modern transportation network on two different levels. However, despite the strategic importance of the project to the government, the construction of Nobiru port itself proved unsuccessful, and the attempt to establish it as the central link in a nation-wide transportation system must also be adjudged a failure.

Two types of factors may be adduced to explain the collapse of the Nobiru



project: indirect social and economic causes and direct causes of a technical nature. With respect to the former, the fact that Nobiru port was constructed as an integral part of the state's Tōhoku policy, a policy which was inseparable from the industrial development program and the politics of samurai appeasement, is problematic. The central government's political designs are obvious here, and the project became involved with regional vested interests. A rigorous examination of the plan's economic features and its technical possibilities, an indispensable condition for success, tended, as a result, to be pushed aside by political considerations.

The harbor plan was conceived as part of a broader program designed to speed the development of transportation and communications in Japan and was implemented on orders from above, but later, when the financial and technical barriers to railroad construction had been removed, water transport, doomed, was gradually supplanted by the railway. A keen awareness of the potential role of rail transport at this time was, in addition to purely technical factors, one of the reasons behind the decision to abandon the second phase of construction at Nobiru.

Turning now to the technical side of the project, Dutch port technology must be pointed to as one of the major underlying defects of the plan. Developed for use in the quiet seas around Holland, this technology proved wholly inadequate in the rough waters off of Japan's northwestern coast. Moreover, silting in the estuary that formed the harbor entrance, which continued for the six years the port was under construction, was particularly heavy, and it became necessary to find a deep-water anchorage for large-scale vessels beyond the breakwaters. This meant that the big ships anchored here were exposed to winds from the south and east and unable to take on goods or discharge their cargos. When the first phase of construction had been completed, Interior Minister Yamagata appointed a team of specialists to explore the possibilities of building a breakwater at Miyato Island, as provided for in phase II of the original plan. According to the results of their survey, however, the plans drafted by Van Doorn, who had proposed a small-scale jetty, were inadequate, and the construction of the breakwater itself was seen to be problematic and success therefore uncertain.

Returning to the question of Dutch port technology, the Dutch built breakwaters by laying down a foundation of twigs and branches and then covering them over with paving stones. In view of the natural conditions existing at Nobiru, logs covered with copper plate were used to reinforce these structures. However, this method proved in the end to be incapable of resisting the heavy offshore seas over a long period of time. Reflecting on the reasons for this rather reckless application of foreign technology, two factors in particular come to mind: (1) Dutch technology had already been used with fair success in constructing riparian works and thus held great interest for the Japanese; (2) no other alternative technology was then known in Japan. The uncritical application of foreign engineering techniques in a Japanese setting, then, brought about the total failure of the Nobiru project.

A final question concerns the motivating force that underlay the planning and

execution of the Nobiru plan. By the time Ōkubo's administrative reforms had succeeded in concentrating power in the Ministry of Interior, the best and brightest civil servants, many of whom had only recently returned from studying abroad, had already been recruited and brought together there. It was this group of enterprising young officials that shouldered the real responsibility for carrying out the Nobiru plan. Attached to the bureaucracy in an auxiliary capacity, foreign specialists in fact exercised relatively little authority and carried no real responsibility for national development projects. Their expertise was called upon mainly to compensate for gaps in the technical training of Japanese experts, and their role in Meiji's economic development was only a temporary and transitional one. As dynamic young civil servants with engineering backgrounds and foreign experience were brought up within the bureaucracy, foreign specialists were gradually phased out and replaced.

It is said that technology cannot be introduced where there exists no foundation to receive it. It is clear in the case of Japan that one must look closely at the machinery the Meiji state set up to receive foreign technology and to best use the technical experts it hired from abroad. But this is a question for future research.

#### REFERENCES

1. "Genya kaikon no gi ni tsuki ukagaisho" [Letter of inquiry concerning the reclamation of wasteland] (March 7, 1878), in *Ōkubo Toshimichi monjo* [Ōkubo papers], Vol. 9 (Tokyo: Nihon-shiseki-kyōkai, 1929).
2. HIROI, I. *Nihon chikukō-shi* [History of Japanese port construction] (Tokyo: Maruzen, 1932).
3. "Ippan shokusan oyobi kashizoku jusan no gi ni tsuki ukagai" [Inquiry concerning the general development of industry and the creation of employment for the nobility and ex-warrior class] (March 6, 1878), in *Ōkubo Toshimichi monjo* [Ōkubo papers], Vol. 9 (Tokyo: Nihon-shiseki-kyōkai, 1929).
4. "Ishinomaki-ken shutchō ni tsuki ukagai tatematsuri sōrou kakitsuke" [A report presented at the occasion of inspection tour to Ishinomaki] (January 1870), Ōkuma monjo [Ōkuma papers] A450, Waseda University, Tokyo.
5. ISHIZUKA, H. "Ōkubo seiken no seiritsu" [Establishment of the Ōkubo regime], in *Nihon shihonshugi seiritsushi kenkyū* [A study on the establishment of capitalism in Japan] (Tokyo: Yoshikawa-kōbunkan, 1973).
6. "Kaisakuhi zōka no ken" [Request for additional funds for excavation], Kōbunroku [Official documents] (February 1884, Ministry of Interior No. 1), National Archives, Tokyo.
7. KUROSAKI, C. "Meiji zenki suiun no shomondai" [Some problems relating to waterway transportation in the early Meiji period], in *Kindai Nihon yusōshi* [History of modern Japanese transportation] (Tokyo: Seizandō-shoten, 1979).
8. *Meiji zaiseishi* [The history of finance in the Meiji period], Vol. 8, *Kokusai (1)* [Government bond (1)] (Tokyo: Yoshikawa-kōbunkan, 1972).
9. *Meiji zenki zaisei keizai shiryō shūsei* [Financial and economic documents of the early Meiji period], Vol. 11, *Meiji-nenkan beika chōsetsu enkakushi* [A history of rice price control in the Meiji period] (1931; Tokyo: Hara-shobō, 1979).
10. "Miyagi-ken chihō nite shōrai okosubeki jigyō ni kansuru ikensho" [A report on the prospective enterprises to be set up in Miyagi Prefecture] (September 1881), Ōkuma monjo [Ōkuma papers] A989, Waseda University, Tokyo.
11. "Miyagi-ken dōro unga kaichikuho hojo no ken" [Request for assistance for the con-

- struction fund for roads and canals in Miyagi Prefecture], *Kōbunroku* [Official documents] (September 1883, Ministry of Interior No. 2), National Archives, Tokyo.
12. "Miyagi-ken dōro unga shūchiku no tame kensai boshū no ken" [Inquiry concerning the raising of prefectural bonds for the purpose of road and canal construction and repair], *Kōbunroku* [Official documents] (April 1882, Ministry of Interior No. 4), National Archives, Tokyo.
  13. "Miyagi-kenka Nobiru beishōkaisho iten no ken" [On the transfer of the rice trading center from Nobiru], *Kōbunroku* [Official documents] (May 1885, Ministry of Agriculture and Commerce), National Archives, Tokyo.
  14. "Miyagi-kenka Onagawa-wan chikukō keikaku no ken" [On the port construction project at Onagawa Bay in Miyagi Prefecture], *Kōbunroku* [Official documents] (November 1885, Ministry of Interior No. 1), National Archives, Tokyo.
  15. "Miyagi-kenka unga teibō gai e akusuibori kaisaku ukagai" [Inquiry concerning the excavation of drainage ditches outside the canal embankments in Miyagi Prefecture], *Kōbunroku* [Official documents] (December 1878, Ministry of Interior No. 3), National Archives, Tokyo.
  16. "Miyagi-ken kigyō ikensho-an" [Position paper on the development of industry in Miyagi Prefecture] (September 1881), Ōkuma monjo [Ōkuma papers] A988, Waseda University, Tokyo.
  17. *Miyagi-ken-shi* [History of Miyagi Prefecture], Vol. 8, *Doboku-hen* [Public works] (Sendai: Miyagi-ken-shi-kankōkai, 1957).
  18. "Miyagi yori Yamagata ni tassuru shindō kaisakuhi osage-watashi no gi ni tsuki ukagai" [Inquiry concerning the granting of the new road construction fund running from Miyagi to Yamagata] (May 13, 1878), *Miyagi-ken shiryō* [Historical documents of Miyagi Prefecture], Vol. 9 (Seijibu—kōgyō [Political section—industry]), Cabinet Library, National Archives, Tokyo.
  19. "Nihon suisei dai-110-gō" [Japan's water control policy no. 110], supplement to "Rikuzen Nobiru chikukō ukagai" [Inquiry concerning the Nobiru port construction in Rikuzen], *Kōbunroku* [Official documents] (April 1878, Ministry of Interior No. 3), National Archives, Tokyo.
  20. "Nobiru beishōkaisho e kaigyō menjō kafu no ken" [Request for the approval of the establishment of a rice trading center at Nobiru], *Kōbunroku* [Official documents] (October 1884, Ministry of Agriculture and Commerce No. 1), National Archives, Tokyo.
  21. "Nobiru chikukōhi zōgaku no ken" [Request for additional funds for the Nobiru port construction], *Kōbunroku* [Official documents] (April 1882, Ministry of Interior No. 4), National Archives, Tokyo.
  22. "Nobiru chikukō jigyo no ken" [On the Nobiru port construction project], *Kōbunroku* [Official documents] (July 1885, Ministry of Interior No. 1), National Archives, Tokyo.
  23. "Nobiru chikukō keihi zōgaku no ken" [Request for additional funds for the Nobiru port construction], *Kōbunroku* [Official documents] (May 1880, Ministry of Interior No. 2), National Archives, Tokyo.
  24. "Nobiru-kō shigai kanyūchi baikyaku daikin o motte dōsho kōhi ni shishutsu no ken" [A plan to supplement the port construction budget by raising funds by selling public land to settlers], *Kōbunroku* [Official documents] (August 1881, Ministry of Interior No. 5), National Archives, Tokyo.
  25. "Nobiru-kō yori Matsushima-wan ni tassuru unga kaisetsu no ken" [On the construction of a canal connecting Nobiru port with Matsushima Bay], *Kōbunroku* [Official documents] (February 1883, Ministry of Interior No. 3), National Archives, Tokyo.
  26. "Nobiru shigaichi kyōbai no ken" [On the auction of the Nobiru city land], *Kōbunroku* [Official documents] (June 1883, Ministry of Interior No. 3), National Archives, Tokyo.
  27. "Nobiru shigaichi shūchikuhi betto kurikaewatashi no ken" [Request to receive the allocation of public works fund for the Nobiru city development fund], *Kōbunroku* [Official documents] (April 1882, Ministry of Interior No. 4), National Archives, Tokyo.
  28. "Naisai boshū ni kansuru Dajōkan e no jōshin-an narabini fukoku-an" [Inquiry to the

- Council of State concerning the raising of public bonds and a scheme for promulgation] (March 6, 1878), Ōkuma monjo [Ōkuma papers] A2416, Waseda University, Tokyo.
29. "Sakunami kaidō shunkō" [Opening up of the new Sakunami road], Miyagi-ken shiryō [Historical documents of Miyagi Prefecture], Vol. 17 (15-nen seijibu—kōgyō [Political section—industry in 1882]), Cabinet Library, National Archives, Tokyo.
  30. "Sendai yori Onagawa-wan e tetsudō enchō fusetsu ni tsuki Sendai ihoku kansen sokuryō no setsu Onagawa-wan shisen omo sokuryō seshimu" [An order to conduct the land survey in preparation for the construction of Onagawa branch line linking Sendai and Onagawa Bay on the occasion of the Tōhoku trunk line land survey to be conducted on the area to the north of Sendai] (July 1886), Kōbun ruiju [Collection of official documents] 11-37 (Un'yumon-7, kyōdō-4 [Transportation section—7, bridges and roads—4]), National Archives, Tokyo.
  31. "Shiyō mokuromichō" [A manual of specifications], supplement to "Rikuzen Nobiru chikukō ukagai" [Inquiry concerning the construction of Nobiru port in Rikuzen], Kōbunroku [Official documents] (April 1878, Ministry of Interior No. 3), National Archives, Tokyo.
  32. TAKAHASHI, T. *Miyagi-ken no rekishi* [A history of Miyagi Prefecture] (Tokyo: Yamakawa-shuppan, 1969).